3.0 SUMMARY OF ASSUMPTIONS, LIMITATIONS, AND ERRORS

Suppressor is basically an input data base interpreter with very few imbedded assumptions or limitations. There are no restrictions on the type of platforms that can be modeled, for example. All combat platforms are characterized using some subset of the generic functions representing sensing, talking, shooting, jamming, moving, and thinking.

The decision logic used for lethal engagements, target assignments, jamming, EMCON employment, and reactive movement are also user-defined from a basic set of model-define tactical criteria. These decision criteria can be combined with conjunctions (AND/OR) and prioritized by sequential filtering.

3.1   ASSUMPTIONS

Table 3-1 lists important model assumptions in the implementation of particular functions within Suppressor. For each assumption, the conditions of applicability and a brief assessment of impact are given. The assumptions listed here are at a high level; that is, they are applicable to broad functional areas such as platform movement and target detection. Additional assumptions pertaining to specific functional areas will be included in Section 2 of ASP-II, in the sections describing these FEs, as verification efforts are completed. The assumptions, limitations, and errors are categorized according to the Functional Area Template (FAT) found in Appendix A.

TABLE 3-1.   Assumptions for Suppressor 5.4 by Functional Element.

Functional Element	Assumptions	Conditions of Applicability	Impact
General	The orthographic projection is based upon a spherical earth.	When orthographic is specified in the input, transverse mercator in the default projection.	Some distances may not be accurately represented owing to earth oblateness.
	No interpolation of table data is performed in Suppressor. It is assumed that the user has defined each table for the requisite resolution of the scenario being modeled.	At all times	Database builders must ensure that each table provides sufficient resolution. This becomes important when comparing Suppressor results with actual data or output from other models.
Platform 1.1 Configuration	Player representations have no physical dimensions. They are modeled as point objects at the locations specified.	All players	Point representation does not allow collisions to occur. Cannot model the masking of sensors by the player structure.

TABLE 3-1.   Assumptions for Suppressor 5.4 by Functional Element. (Contd.)

Functional Element	Assumptions	Conditions of Applicability	Impact
Platform 1.2 Movement	The paths and orientation of moving players can be adequately modeled using a 3-DOF model with the orientation of the vehicle aligned with the velocity vector.	Applies to any moving player.	Yaw, pitch, and roll are not independent variables as they are in 6-DOF models. Instead Suppressor always aligns the yaw and pitch of a mover with its velocity vector and computes a roll angle based on its speed and turn radius. Care should be exercised when simulating helicopter targets for which detailed signature data are available (as helicopters ascend and descend, their noses are not oriented along the velocity vector
Platform 2.0 Sensors	Beamwidth, target size, and range are not considered when determining the number of targets sensed.	Pertains to modeling long-range acquisition radar systems detecting aircraft in tight formations.	Two or more targets in tight formation are always distinguished if the S/N is adequate. In an actual radar system, these targets may not be distinguished. This perception may affect the assignment of resources (such as interceptors or missiles) to these targets.
	Tracking errors are not explicitly modeled.	All tracking sensors	Tracking break-locks due to deceptive ECM are difficult to model or calibrate to the results of higher-fidelity engagement analysis.
	Acoustic sensors are not modeled.	Scenarios where subsurface platforms are employed.	Cannot analyze the effect of acoustic sensors.
Platform 3.0 Weapons	Guidance for controlled, implicit weapons is assumed to be perfect.	Applies to all controlled, implicit weapons.	The weapon will always intercept the target unless the linked track sensor loses lock.
Platform 4.0 Comm Devices	Message quality is not incrementally degraded. It is either perfectly received or not received depending on the signal-to-interference ratio.	Applies to all communications.	This assumption makes message transmission a deterministic even and eliminates random variations in communications effectiveness.

TABLE 3-1.   Assumptions for Suppressor 5.4 by Functional Element. (Contd.)

Functional Element	Assumptions	Conditions of Applicability	Impact
Platform 6.2 Knowledge Base	A player's self-perception is always perfect.	Applies to all players. Player self-perception includes own position, orientation, speed, etc., status of various systems, resources remaining, etc.	May provide an optimistic representation of the knowledge state of a player. Modeling inaccuracy in the perception of a player's own position may be important in some weapon targeting situations. For system status, this limitation is related to the lack of simulated communications internal to a player.
	The experience of a player is not explicitly characterized in Suppressor.	Applies to reactions and decisions by human operators which may vary with training and proficiency.	Many of the effects of experience are characterized by various delay times (e.g., TIME-TO-THINK tables) an in the criteria chosen for the Resource Allocation procedures.
Platform 6.3 Logic Process	Sensor data fusion and correlation is assumed to be perfect.	Applies when decisions are made using information from multiple sensors.	This assumption eliminates potential ambiguities in situational awareness and target tracking which impact the effectiveness of command and control. Input data items are available to introduce errors in Target Tracking and filter data into one track.
Environment 2.0 Topographic Characteristics	Multipath and diffraction are not modeled.	Primarily affects low-altitude detection and tracking over smooth terrain or water.	Minimal effect on model use. Multipath effects on detection are usually small, but if desired, one possible work-around is to include ground effects in the antenna gain patterns.

3.2   LIMITATIONS

Table 3-2 lists known model limitations, and assesses the conditions of applicability and potential impact for each limitation. Model limitations are discussed in greater detail in Section 2 of ASP-II. New limitations may be uncovered as further analysis is conducted. Similarly, as enhancements are added to new versions of Suppressor, some of these limitations may be eliminated.

TABLE 3-2.   Table of Limitations for Suppressor 5.4.

Functional Element	Limitations	Conditions of Applicability	Impact
General	The largest geographic area modeled is limited to an area accurately represented using a Cartesian coordinate system.	This limitation would only affect the simulation of a worldwide scenario.	Impact would be minimal, since such a large geographic area would not likely be required for a mission level model.
	Scenario times are limited by computer word length and thinking time delays.	For typical thinking time delays of 0.1 seconds and an eight byte floating point word, the maximum scenario length is about 11-12 days (accounting for roundoff errors). For shorter thinking times, such as 0.001 seconds, the maximum scenario time is about 3 hours.	Minimal impact for a mission-level scenario
	Distance and position are not resolved to an accuracy greater than seven digits.	At all times	Minimal impact
Platform 1.2 Movement	Formation tactics are not explicitly modeled.	Affects scenarios when formation tactics are desired.	Difficult to achieve high fidelity air-to-air engagement modeling.
	Suppressor uses a single number to represent the acceleration limits of an aircraft.	Applies to all platforms.	If detailed acceleration profiles are important this representation may be inadequate.
Platform 5.0 CM/CCM	CM systems are primarily modeled as disruptors which add noise to the receiver signal-to-noise equation. CM systems which utilize deceptive techniques such as range-gate or velocity gate stealing must currently be modeled as noise disruptors.	Applies when simulating any CM system which employs deceptive techniques.	Suppressor can simulate the effects of these CM techniques by denying sensor data.

TABLE 3-2.   Table of Limitations for Suppressor 5.4. (Contd.)

Functional Element	Limitations	Conditions of Applicability	Impact
Environment 1.0 Atmospheric Characteristics	Suppressor uses a single loss table for each sensor receiver type.	Applies if a scenario includes weather fronts or cloudy regions that are not uniform over the entire region.	The TRANSMISSION-LOSS tables may be inadequate to represent signal attenuation at each receiver
	The background radiance for a sensor detecting a target is constant. The orientation of the sun relative to the sensor and target is not currently taken into account.	Applies to situations when the sun or other significant factors in target background affect the performance of sensors. Infrared sensors in Suppressor utilize tabular data for background radiance and solar irradiance. Both tables include data which vary with target altitude.	May produce inaccurate IR target detection and tracking results for particular geometries.
Environment 2.0 Topographic Characteristics	Only one clutter table can be defined for each sensor type, even though the scenario may include multiple sensors of the same type at different locations	For scenarios containing multiple sensors at separate sites, with each site having appreciable different clutter profiles, the calculation of clutter return at some sites may be unrealistic.	Impact on target detection primarily for sensors lacking sophisticated clutter-rejection filters.
Command Control and Communication (C^3) 1.0 Command Chain Hierarchy	A player designated as the alternate commander must be a subordinate of the original commander.	Applies when addressing C^3 reorganization, when the alternate commander should be a player at the same level or higher than the original commander.	Suppressor users must work around the limitation by using multiple command chains. In the second chain the desired alternate commanders are subordinate to the original commander.

TABLE 3-2.   Table of Limitations for Suppressor 5.4. (Contd.)

Functional Element	Limitations	Conditions of Applicability	Impact
Command Control and Communication (C^3) 2.0 Network Communications	Communications can occur only between two players who are in the same command chain; either peer-to-peer, commander-to-immediate subordinate, or subordinate to immediate commander.	Applies to all communications.	This limitation may restrict desired connectivity. A work-around where additional (dummy) command chains are defined might be feasible.
	There is only one active operating frequency stored and used for each communications network, even if different frequencies were specified for the individual participating communications receivers.	Applies when the user attempts to define a communications network having multiple frequencies.	In the source code, there is an implicit assumption that the frequencies specified for each communications receiver belonging to the same network will be the same. If the database developer does not make them the same, the last frequency encountered in the input for a receiver on a particular network will be the one used by all signal calculations for messages sent across the network.

3.3   ERRORS

Errors are conditions in which a correct model input set will cause a model run to abort or to give an incorrect result. Table 3-3 lists known errors in Suppressor 5.4, and assesses the conditions of applicability and potential impact for each error. Also included in the table are errors in the model's documentation. This table is quite brief because Suppressor 5.4 is new, and this version corrected all problems reported for earlier versions. Errors identified and corrected in Suppressor 5.3 are listed in Appendix B for historical reference.

TABLE 3-3. Table of Errors for Suppressor 5.4.

Functional Element	Errors	Conditions of Applicability	Impact
Platform 1.2 Movement	The TIME-WINDOW modifier for a planned path can cause path points to be computed with negative speed values. This can cause an infinite loop in the scheduling of sense events for sensors trying to detect this moving target.	Only occurs when using TIME-WINDOW in the SDB path specification.	Suppressor users can check planned paths written during SDB processing and easily identify these problems before starting a simulation.
Environment 2.0 Topographic Characteristics	When using variable resolution terrain, there is a potential infinite loop in the line-of-sight algorithm, subroutine TRILOS.	Can only occur when using a terrain model with variable resolution terrain.	Suppressor users can prevent this problem by using only terrain models with a constant level of resolution.
Command Control and Communication (C3) 2.0 Network Communications	If a player has two or more communication systems on the same net, the simulation can abort.	Occurs when defining redundant communications systems on the same net.	Suppressor users can prevent this problem by placing each communications system on a separate net.

3.4   IMPLICATIONS FOR MODEL USE

Suppressor is best suited to mission-level applications. It was not intended for one v. one engagement modeling, and it lacks many aspects of fidelity generally required for this level of analysis. Platform movement employs a modified 3 degree of freedom (3 DOF) model described in Section 3.1. Tracking errors are not explicitly modeled, so that the effects of deceptive ECM techniques and target defensive maneuvers cannot be explicitly portrayed. Similarly, Suppressor was not intended to support campaign-level simulation. It lacks the capability to model resupply and logistics, regenerate forces, and adaptively change tactics. The time extent of a scenario is also limited.